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PROGRESS REPORT

December 20, 1972 - February 19, 1973

Crop Identification & Acreage

Measurement Utilizing ERTS Imagery 013

Principle Investigator

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(E73-10328) CROP IDENTIFICATION AND  
ACREAGE MEASUREMENT UTILIZING ERTS IMAGERY  
Progress Report, 20 Dec. 1972 - 19 Feb.  
1973 (Department of Agriculture) 12 p  
HC \$3.00

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## ERTS Imagery and Aerial Photography

The ERTS-1 imagery and digital tapes and the aerial photography currently available with useable district coverage are presented Tables 1-8 on the following pages. The ERTS 70mm chips were used for a "quick look" to determine whether portions of our test sites were clearly visible, so additional orders should be made. The 9.5" color transparencies are used for photo interpretation and pinpointing test area locations with a grid overlay.

Aerial photography from NASA and the South Dakota Remote Sensing Institute assist greatly in locating the small land area segments on the ERTS photographs. Since aerial photos are not available for test segments which fall outside the flight lines, hard copy 38"x38" color composites have been ordered from the Western Aerial Photography Laboratory, ASCS-USDA, at Salt Lake City, Utah. These large prints are of good quality and enable photo interpreters to find segment and field boundaries more easily.

Complete coverage of the test districts under study is provided by the following ERTS photos:

Missouri	- 1071-16111 & 1071-16113
Kansas	- 1060-16512 & 1025-16565
South Dakota	- 1060-16491 & 1095-16442
Idaho	- 1053-17524, 1053-17531, & 1052-17472

In addition to using aerial photos for finding and visually interpreting the land area segments on a current basis with the ERTS image, the aerial photography will play an important role in developing new estimating models with combination ground, air, and satellite crop identification. High altitude photography will be scanned by a microdensitometer and the optical densities recorded on tape. Discriminant analysis of this data will be compared with ground truth and with classification results with ERTS data. Interpretation of digital data from the aerial photos should enhance our understanding of the ERTS information.

TABLE 1

## MISSOURI

## ERTS Photos &amp; Tapes

<u>I.D. NO.</u>	<u>Scene Date</u>	<u>70mm Photo Rec'd</u>	<u>9.5" Color Rec'd</u>	<u>CCT Rec'd</u>		<u>Dist. Coverage</u>
				<u>Bulk</u>	<u>Prec.</u>	
1034-16052	8/26	10/6		11/17	12/22	NE 50%
1034-16055	8/26	10/6	2/26/73	11/22	12/19	S 40%
1035-16112	8/27	11/9				95%
1052-16052	9/13	12/26		11/15		NE 50%
1052-16055	9/13	12/26		11/18		S 40%
1070-16052	10/1	11/1	2/28/73	1/29		NE 50%
1070-16055	10/1	11/1	2/28/73	12/27		S 40%
1071-16111	10/2	11/1	2/28/73	12/27	2/28	N 50%
1071-16113	10/2	11/1	2/28/73	12/22	2/28	S 75%
1089-16113	10/20	12/6		1/24		S 75%
1089-16120	10/20	12/6		1/24		SW 60%
1106-16060	11/6			12/8		NE 60%
1106-16063	11/6			12/8		S 50%

## KANSAS

## ERTS Photos &amp; Tapes

<u>I.D. NO.</u>	<u>Scene Date</u>	<u>70mm Photo Rec'd</u>	<u>9.5" Color Rec'd</u>	<u>CCT Rec'd</u>		<u>Dist. Coverage</u>
				<u>Bulk</u>	<u>Prec.</u>	
1007-16563RBV	7/30	8/31			10/20	N 20%
1023-16454MSS	8/15	-		11/15		SE 10%
1025-16565	8/17	10/5			12/4	W 60%
1025-16571	8/17	10/5		11/15	2/28	SW 15%
1043-16570	9/4	10/6		11/15		W 60%
1060-16505	9/21	11/3		11/22		NE 15%
1060-16512	9/21	11/3		11/15		E 80%
1061-16564	9/22	10/25		2/21		N 20%
1061-16570	9/22	10/25		2/5		W 60%
1095-16460	10/26	11/22	2/20	1 1/22	1/10	E 20%

TABLE 3

## SOUTH DAKOTA

## ERTS Photos &amp; Tapes

<u>I.D. NO.</u>	<u>Scene Date</u>	<u>70mm Photo Rec'd</u>	<u>9.5" Color Rec'd</u>	<u>CCT Rec'd</u>		<u>Dist. Coverage</u>
				<u>Bulk</u>	<u>Prec.</u>	
1023-16440	8/15			11/16		SE 40%
1024-16491	8/16			11/9		N 80%
1025-16545	8/17	9/22			2/5	NW 5%
1025-16551	8/17	9/22			2/5	W 10%
1041-16433	9/2	10/19		11/16	12/19	NE 40%
1041-16435	9/2	10/19		11/9		SE 30%
1042-16491	9/3	12/28		11/9		N 80%
1043-16550	9/4	10/12	2/26	11/17	1/10	W 10%
1060-16491	9/21	11/2		11/9		N 80%
1060-16494	9/21	11/2		11/15		SW 25%
1077-16440	10/8	11/17	2/20		1/29	SE 30%
1078-16492	10/9	11/8		11/9		N 80%
1095-16440	10/26	11/22	2/20	11/20	2/5	NE 40%
1095-16442	10/26	11/22	2/20	11/20	1/8	SE 30%
1114-16500	11/14	12/12		1/8		N 80%
1114-16502	11/14	12/12		12/19		SW 25%

TABLE 4

## IDAHO

## ERTS Photos &amp; Tapes

<u>I.D. NO.</u>	<u>Scene Date</u>	<u>70mm Photo Rec'd</u>	<u>9.5" Color Rec'd</u>	<u>CCT Rec'd</u>		<u>Dist. Coverage</u>
				<u>Bulk</u>	<u>Prec.</u>	
1034-17470	8/26	10/20		11/22	1/24	NE 25%
1034-17473	8/26	10/20		11/9	12/19	SE 40%
1035-17525	8/27	10/20		11/15	12/22	N 80%
1035-17531	8/27	10/20		11/8	12/19	SW 40%
1036-17583	8/28	10/6		11/8		NW 15%
1052-17470	9/13	11/3		11/8		NE 25%
1052-17472	9/13	11/3		11/8		SE 40%
1053-17524	9/14	10/19	2/26	11/8	12/19	N 80%
1053-17531	9/14	10/19	2/26	11/8	12/19	SW 40%
1054-17583	9/15	10/18		11/9	12/19	NW 15%
1054-17585	9/15	10/18		11/9	12/19	SW 5%
1071-17524	10/2	11/6		11/1		N 80%
1071-17531	10/2	11/6		12/8		SW 80%
1072-17583	10/3	11/9				NW 15%
1107-17532	11/7	12/6		12/8		N 80%

TABLE 5

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## ERTS PROJECT

## MISSOURI AERIAL PHOTOGRAPHY

Mission; Date	: 208; 8/28/72	:	211; 9/19/72	:	S.D.R.S.I.: 8/19-20/72
Camera, Roll	: RC-8; 33 : ZEISS; 34	:	RC-8; 42 : ZEISS; 44	:	4 filters
Segments	: Frame No.: Frame No.	:	Frame No.: Frame No.	:	Frame No.
F.L. 2					
4418	29	--	99	--	38 & 39
4420	31	55	98	25	42
F.L. 8					
4411	05	7	127		3
3412	07	--	124		28 & 29
1413	07	12	124	78	19 - 25
4414	04	6	128	84	6 & 7
1435	13	22	120	69	9
3436	10	17	122	73	2
4458	11	--	121		
4460	08	16	123	76	32 & 33
Extra					
3416	28	--	--		
4417	30	53	98		
4419	29	--	99		
3432	15	--	118		
4434	12	--	120		
4437	10	--	123		
Training					
2A1	31	55	97	23	44 & 45
2A2	30	55	98	24	47 - 53
2B	29	--	100		29 & 30
2C	29	--	99		33
2D	28	49	100		25 & 26
8A	05	6	128	85	11 & 12
8B	07	12	125	79	14 & 15
8C	11	18	121	72	37 & 38
8D	11	19	121	72	5 & 6
8E	12	--	120		41 & 43
8F	15	26	118	64	15 & 16

## ERTS PROJECT

## HIGH ALTITUDE AERIAL PHOTOGRAPHY

## KANSAS

Mission; Date: 208; 8/18/72 : 211; 9/17/72 : S.D.R.S.I.; August 12-14, 1972  
 Camera; Roll : RC-8; 1 : ZEISS; 3 : RC-8; 33 : ZEISS; 35:4° Filters of 4 Rolls Each

Segments	Frame No.	Frame No.	Frame No.	Frame No.	Frame No.
F.L. 3					
4087	41	-	19	-	B26 - 31
1089	43	85	17	29 & 271	-
4101	48	95	13	20 & 280	A27 - 30
3106	37	72	23	259	B 1 - 5
4107Noc	34	66	27	-	C40
1113	53	107	07	08 & 291	A53 - 56
4114	50	100	10	16 & 285	A34 - 38
1115	40	79	21	265	B12 - 15
3116	41	81	19	268	B22
F.L. 10					
4120	14	26	-	-	D12 - 16
3122	24	48	-	-	C23 - 26
4124	18	35	-	-	C 1 - 8
1125Noc	Noc	-	-	-	-
4130	22	43	-	-	C17 - 19
Extra					
4088	44	-	17	-	-
Training					
3-A	50	101	10	14 & 286	A42
3-B	36	70	25	45	C36
3-C	37	72	24	260	-
3-D	40	81	20	266	B 7 & 8
3-E	40	81	20	267	B18
3-F	42	83	19	32 & 269	B39 - 51
3-G	42	83	19	32 & 269	B57 - 64
3-H	43	-	17	-	B36
3-I	43	85	17	30 & 272	A 3
3-J	43	87	17	28 & 273	A 8
3-L	46	-	14	-	A15
3-M	47	-	13	-	A18
3-P	54	109	06	07 & 293	A49 & 50
10-A	24	-	-	-	C32
10-E	9	17	-	-	D 2 - 5

Note: RC-8 and ZEISS coverage of segments  
 1113, 4114, and 3A are also available  
 from Mission 217 dated 10/24/72/.



TABLE 7

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## ERTS PROJECT

## SOUTH DAKOTA AERIAL PHOTOGRAPHY

Mission; Date	: 211; 9/22/72	: 211; 9/14/72	: S.D.R.S.I.: 8/27/72
Camera, Roll	: RC-8; 54 : ZEISS; 56	: RC-8; 17 : ZEISS; 19	: 4 filters and 4 rolls
Segments	: Frame No. : Frame No.	: Frame No. : Frame No.	: Frame No.
F.L. 3			None
3196	2934	70	46
4197	2932	66	54
1199	2934	71	50
4210	2930	62	5 & 6
F.L. 5			None
1213	2908	18	26
1223	2912	27	14
3236	2906	14	35
4237	2906	--	32
4240	2915	--	8
Extra			None
1195	2934	--	
4198	2933	69	
4208	2928	--	
4211	2928	--	
3212	2909	--	187
4214	2908	20	188
3222	2913	--	--
4224	2912	27	184
1235	2906	--	190
1239	2918	--	179
4241	2918	39	179
Training			None
3-A3	2930	62	1
3-B-9	2933	68	53
3-C-3	2935	--	44
3-C-5	2935	72	48
3-C-6	2935	--	41
3-D-8	2935	74	38
5-C-2	2913	27	12
5-C-3	2913	29	20
5-C-4	2913	29	16
5-E-2	2908	17	29

## ERTS PROJECT

## IDAHO AERIAL PHOTOGRAPHY

Mission; Date	: 72-138; 8/11/72	: 9/7/72	: 10/25/72
Camera	: RC-8	: RC-8	: RC-8
Segments	: Frame Number	: Frame No.	: Frame No.

## F. L. 5

8101	4702,4812-13	3885-86,3900-01	5565-66,5652-53,5820
8103	-	3881	5647
8111	4699-4700,4814-15	3884-85,3902-03	5650-51
3423	4816	3904-05	-
1554	4699,4814-15	3883-84	5650-51
1559	4699,4815-16	3883-84,3903-04	5650,5667

## F. L. 6

8094	4812	3900-01	5664,5822
8098	4811-12	3899-3900	5817,5663-64
8109	4813	3886,3901-02	5665
9110	4700,4814	3884-85,3901-02	5661,5665-66
8113	4814-15	3902-03	5666-67
8265	4816	3904-05	5668
2332	4811-12	3899-3900	5663,5817
8339	4816	3904-05	5668
3422	4812-13	3900-01	5664,5821-22

## EXTRA

8096	4703		
8099	4701		
8102	4701		
8112	4814	3902-03	5666-67
8115	4701		
1549	4702		
1550	4702		

## TRAINING

5-A-2	4702-03,4810-11	3887-88,3899	5654,5817-18-19
5-B-2	4702,4812-13	3886-87,3900-01	5653,5820
5-C-2	4814-15	3884-85,3902-03	5665-66
5-D-2	4699-4700,4814-15	3884-85	5650-51
5-K-5	4815	3903-04	5667
5-K-6	4815	3903-04	5667
6-C-2	4812-13	3900-01	5664-65,5821-22
6-D-1	4812-13	3900-01-02	5664-65,5812-22
6-F-3	4813-14	3901-02	5665-66,5821
6-F-4	4813-14	3901-02	5665-66,5821
6-H-1	4814	3901-02	5665-66
6-H-2	4814	3901-02	5665-66
6-I-1	4814	3902-03	5666-67
6-I-2	4814	3902-03	5666-67
6-J-4	4814-15	3902-03-04	5666-67
6-L-4	-	3902	5665-66,5822-23,9095

EPDPenn State Classifier

The Penn State Classification programs were received from Dr. Borden near the end of December 72. The package has been added to our library and all decks have been successfully compiled. Implementation has been slowed because support subroutines provided by the Penn State Computer Center were not included with the original package. In addition, one of the Penn State Computer Center routines, REREAD, does not work at the Washington computer center. All the major processing routines use this subroutine; and until the bug is fixed, or a substitute routine found, the Penn State System will not run. We are getting support from Dr. Borden, the Penn State Computer Center, Washington Computer Center, and some other knowledgeable programmers in USDA, to help with this problem.

Statistical Analysis System

SAS (Statistical Analysis System) is up and running. It has been used successfully to perform a discriminant analysis of multispectral data, digitized from aircraft color IR photography (see program report August 20-October 19, 1973). As a result it was decided to have SAS capabilities extended. Specification are being written to have SAS draw a sample of data points from a standardized multi-channel picture, and perform several kinds of discriminate analysis. The idea is to test different kinds of analysis procedures and data reduction scheme to find one that work well with a minimum amount of data and still permit crop classification.

Segment Location Program

Testing of a series of programs which will identify and extract data for a number of specified areas within an ERTS-A data frame is nearing completion.

The identification program computes the location of the scan lines which cross any specified area, and the location of the data points on those scan lines which would fall within that area. Parameters used by this program are the spacecraft heading, geographic center of the data frame, and the geographic location of specified area(s).

A second program reads the ERTS-A tape to the indicated scan lines, extracts the data for the indicated points, and passes this data on to a third program which unpacks the data. A gray-scale printout of the subarea will also be produced.

Alternate sets of programs are being developed to handle either bulk or precision-made data tapes.

Other programs to identify and extract data for individual fields from the sub-areas are also being developed.

### Ground Observations

The updated ground observations for Missouri, Kansas, and South Dakota has been summarized for all visits. Cost data is being summarized.

### Microdensitometer

The solicitations were sent out on February 15, 1973, for the microdensitometer. They must remain open and in the market for one full month. On March 15, 1973, the bids will be opened and evaluated and the lowest bidder will be awarded the contract.